Panasonic

4400I

ANALOG MULTI DETECTOR WITH ISOLATOR

Fire alarm solutions
technical description

www.panasonic-fire-security.com

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1. INTRODUCTION

This document describes the Analog multi detector with isolator, type number 4400I.
The document contains information about the product and instructions on how to mount and connect it.

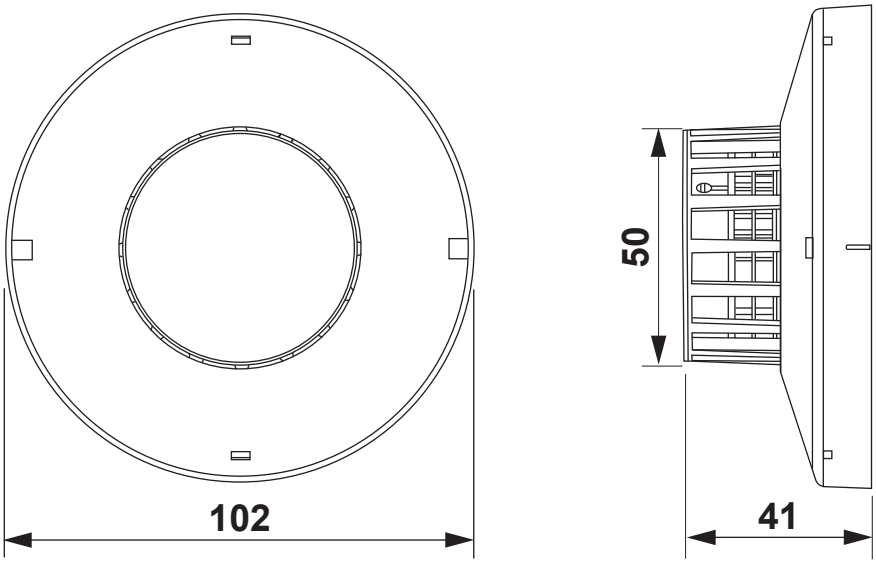
2. ABBREVIATIONS

CCF	Contamination Compensation Factor	
CIE	Control and indicating equipment	= control unit
IR	Infrared	
LED	Light Emitting Diode	

3. GENERAL DESCRIPTION

The analog multi detector consists of one photoelectric (optical) smoke detector and one heat detector within the low profile housing. The 4400I multi detector is not backwards compatible with older detector types. Only **Advanced mode** is supported.

The unit is intended for indoor use and in dry premises.



(Measure in mm)

3.1. LED

The detector has two red LEDs that are activated (flashing) when the detector is in fire alarm state.
The red LEDs can also be activated via function `Toggle LED`. For more information, see Planning instructions for the system, version 2.4.x or later.

The detector also has a green LED, which has four possible patterns

- Off
- Flash (20 ms) - the detector is polled by the CIE.
- Flash (250 ms / 3s) - the detector is in test mode
- Flash (250 ms / 1s) - the short circuit relay is opened.

The green LED turns off when the detector gets command from the CIE to light up the red LEDs.
When the detector gets command to turn off the red LED (normal state) the green LED resumes its previous pattern.

3.1.1. ADDRESS SETTING CHECK

The red LEDs will be blinking every 3 seconds when the detector is powered and the COM Loop address is not set, that is as long as the address is “000”.

3.2. IR LED

The smoke detection chamber consists of an IR LED and a photodiode. Reflection of the infrared light is used to detect smoke. The smoke enters the detection chamber through an insect filter and an optical labyrinth. This construction improves the smoke inflow and also causes steam to condense on the outer surface, to prevent nuisance alarms.

3.3. SHORT CIRCUIT ISOLATOR

The 4400I multi detector has a built-in short circuit isolator that requires no separate COM loop address. Like any other short circuit isolator, it will be given an individual sequence number when programmed in EBLWin.

The isolators have to be connected consecutively regarding sequence number 00-127, in the COM loop's A-direction.

The built-in short circuit isolator will divide the COM loop into segments. A segment is the part of a loop between two isolators or between one isolator and the CIE. In case of a short circuit on a COM loop, only the affected segment will be disabled, all other loop units will continue to work normally.

DATA

Parameter	Symbol	Value
The maximum line voltage	V_{max}	30V DC
The nominal line voltage	V_{nom}	24V DC
The minimum line voltage	V_{min}	12V DC
The maximum rated continuous current with the switch closed	$I_{C\ max}$	350 mA
The maximum rated switching current on short circuit conditions	$I_{S\ max}$	2 A
The maximum leakage current with the switch open	$I_{L\ max}$	500 µA
The maximum series impedance with the switch closed	$Z_{C\ max}$	90 mΩ
The maximum voltage at which the device isolates (i.e. close to open)	$V_{SO\ max}$	11V DC
The minimum voltage at which the device isolates (i.e. close to open)	$V_{SO\ min}$	5V DC
The maximum voltage at which the device will change from open to close.	-	N/A[1)]
The minimum voltage at which the device will change from open to close.	-	N/A[1)]

1) The device can change from open to close by commands from the control and indicating equipment only. This can be done at minimum to maximum line voltage, i.e. 12V DC – 30V DC.

For more information on short circuit isolators, see the Planning instructions for EBLOne, EBL128 or EBL512 G3 version 2.3.x or later.

4. FIRE ALARM

4.1. FIRE JUDGEMENT

Artificial Intelligence uses combined smoke and heat sensing for the fire judgement. This will secure real fire alarms and minimize the not wanted nuisance alarms, for example due to artificial smoke or oil mist.

The fire judgement is depending on:

- (S) Smoke obscuration %/m
- (T) A fixed temperature °C
- (delta T) Temperature rise °C/168 sec.

4.1.1. ALARM THRESHOLD LEVELS

There are alarm threshold levels (**S**, **T**, **deltaT** and **2S+deltaT**) not only for fire alarm but also for pre-warning and heavy smoke / heat alarm.

Area alarm algorithm	S [% / m]	T [degrees]	ΔT [deg. / 168 sec]	2S+ΔT
Normal (default)	5	57	18	12
Smoke / Steam (longer delay time)	5	57	18	12
Clean (higher sensitivity)	3.7	57	18	10
Heater	5	57	Not used	12
Cooking / Welding	5	57	18	14

4.1.2. ALARM THRESHOLD LEVELS FOR HEAT DETECTION

If the control and indicating equipment is configured using 4400I as heat detector, the following categories are available. The categories are in accordance with EN 54-5.

Adjustment in the control and indicating equipment		T [degrees]
Category A1	if ΔT ≤ 4 degrees / 60 sec	56
	if ΔT > 4 degrees / 60 sec	46
Category A2S		60

4.1.3. ALARM DELAY TIME

The alarm delay time is based on the cause of alarm and the momentary temperature and/or smoke obscuration changes just before and after the alarm threshold level was passed. The delay time before can be shortened to detect fire early, or the delay time can be extended in order to reduce nuisance alarms.
The detector has a counter that will start to count when the alarm threshold level is exceeded. The counter starts at 0 and cannot be negative. When the counter value reaches 9 the delay time starts.

SMOKE

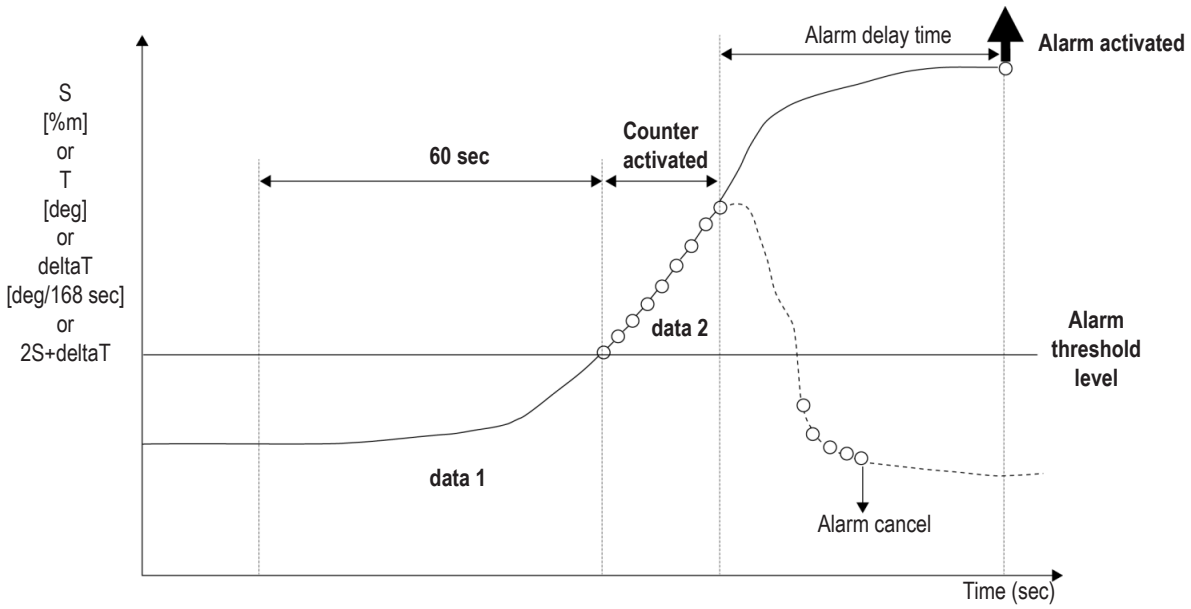
When the smoke obscuration value **S** exceeds the alarm threshold level the counter value increases by 1 every second.
When **S** falls below the alarm threshold level the counter value decreases by 2 every second.

TEMPERATURE

When the temperature value **T** exceeds the alarm threshold level the counter value increases by 3 every second.
When the temperature rise **deltaT** exceeds the alarm threshold level the counter value increases by 3 every second.
When **T** or **deltaT** falls below the alarm threshold level the counter value decreases by 2 every second.

SMOKE AND TEMPERATURE

When **2S+deltaT** exceed the alarm threshold level the counter value increases by 1 every second.
When **2S+deltaT** falls below the alarm threshold level the counter value decreases by 2 every second.



Maximum alarm delay time is 60 seconds.

If the cause of an alarm is **T** or **deltaT** the alarm delay time will be 9 seconds.
The alarm delay time function will be cancelled after 18 seconds if one of the following conditions is true:
S (%/m) > fire threshold level (S) x 2 or **T** (°C) > fire threshold level (T) or **deltaT** (°C/168 sec.) > fire threshold level (deltaT).

Alarm delay time (seconds)					
Area alarm algorithm	**S** **Data 1 (%/m)**		**T**	**deltaT**	**2S+deltaT**
Normal	data 1 < 0.6	45	9	9	data2´/ data2
	0.6 ≤ data 1 < 0.8	30			
	0.8 ≤ data 1 < 2.5	18			
	2.5 ≤ data 1	9			
Smoke / Steam	data 1 < 0.6	45 + data2/2	9	9	data2´/ data2
	0.6 ≤ data 1 < 0.8	30 + data2/2			
	0.8 ≤ data 1 < 2.5	18 + data2/2			
	2.5 ≤ data 1 < 1.3	9 + data2/2			
Clean	data1 < 0.3	45	9	9	data2´/ data2
	0.3 ≤ data1 < 0.4	30			
	0.4 ≤ data1 < 1.3	18			
	1.3 ≤ data1	9			
Heater	data1 < 0.6	45	9	Not used	data2´/ data2
	0.6 ≤ data1 < 0.8	30			
	0.8 ≤ data1 < 2.5	18			
	2.5 ≤ data1	9			
Cooking / Welding	data1 < 0.6	45	9	9	data2´
	0.6 ≤ data1 < 0.8	30			
	0.8 ≤ data1 < 2.5	18			
	2.5 ≤ data1	9			

data1 = The average smoke obscuration value for 60 seconds before the alarm threshold level was passed.

data2 = The sum of the difference between the smoke obscuration value and the alarm threshold level every second during the counter period.

data2' = The sum of the difference between the 2S+deltaT value and alarm threshold level every second during the counter period.

4.2. LEARNING FUNCTION

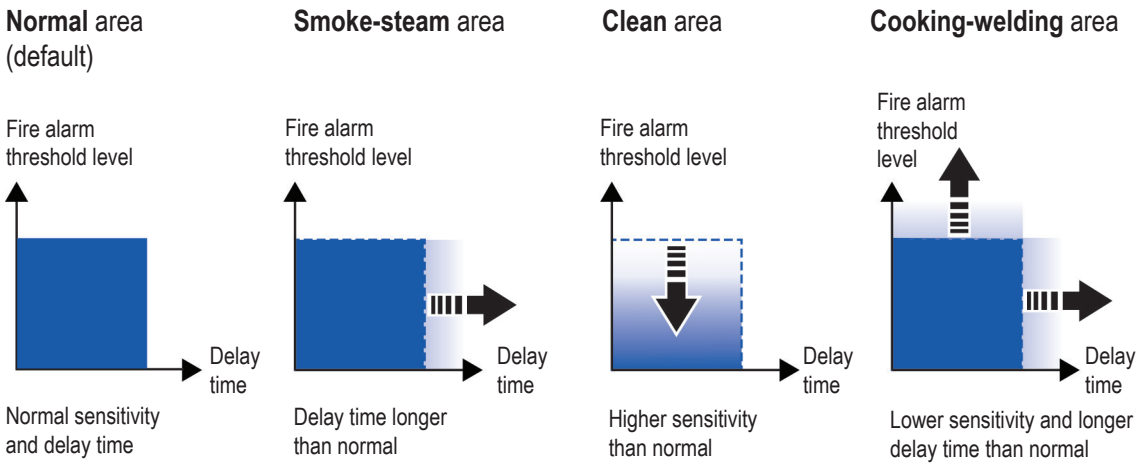
Depending on the local temperature changes and the local occurrence of smoke where the detector is situated, each detector can after a learning period adapt a more appropriate alarm algorithm.
A learning period contains of twenty 36h-periods (20 x 36h = 720h = 30 days = one month).
When three (or more) of the 36h-periods, during the learning period, have exceeded the area alarm algorithm **level**, the area alarm algorithm will be adapted.
For the Clean area alarm algorithm to be adapted there must be no 36-periods that have exceeded the level during a full learning period. The clean area alarm algorithm will be changed back to the Normal area Alarm algorithm directly if any 36h period exceeds the level.
The minimum time for the area alarm algorithm to change back to Normal is one 36h-period.

4.2.1. AREA ALARM ALGORITHMS

Normal area is the default area alarm algorithm for each detector. There are two other **Area alarm algorithms** that can be adapted after the learning period:

- **Smoke** – **Steam area**, is depending on occurrence of smoke, **level 1** = S [%/m] > half the fire alarm threshold level (S)
- **Clean area**, is the most sensitive condition, requiring a very clean and stable environment. The values for **level 1, level 2, and level 3** must not be exceeded
- **Heater area**, is depending on rise of temperature, **level 2** = deltaT [°C/168 sec] ≥ 12 (approx. 4.3°C/min)
- **Cooking** – **Welding area**, is depending on occurrence of smoke together with rise of temperature, **level 3** = 2S+deltaT ≥ 10.

S has to be ≥ 1.0 and deltaT has to be ≥ 3.



The **Heater area** alarm algorithm is similar to the alarm algorithm for the **Normal** area but the rate-of-rise function (deltaT) will not be used for alarm activation.

The learning function for **Heater area** and **Cooking – Welding area** are the same as for Smoke - Steam area but level 2 and level 3 are used instead of level 1.

4.2.2. WITHOUT LEARNING FUNCTION

If the area where the detector is placed is known, for example a kitchen, the learning function should be turned off and the detector should be programmed via EBLWin to its correct algorithm.

If manually set, also an alternative area alarm algorithm can be set that can be controlled via a one or two time channels.

4.3. ANALOG DATA OUTPUT

The smoke obscuration value (%/m) and the temperature (°C) can be shown via the CIE. A new value is calculated in the detector every second. The smoke obscuration value is an average value for the last four seconds.

4.4. HEAT DETECTOR MODE

The 4400I can be used as a heat detector only. The selection of algorithms for 4400I includes A1and A2(S).
The values for these algorithms are the same as for the corresponding algorithms for 4400 in Normal mode.
For more information, see Planning instructions for the system, version 2.4.x or later.

It is not possible to select a multi detector algorithm as the normal algorithm, and then select a heat detector algorithm as alternative algorithm or vice versa.

When a heat detector algorithm is selected, the following fields are greyed-out:

- ***Quiet alarm***
- ***Learning function***
- ***Smoke detector disablement***

4.5. SENSITIVITY COMPENSATION

In order to maintain a constant sensitivity regardless of the contamination of the detector, a Contamination Compensation Factor (CCF) is subtracted from the momentary smoke obscuration values before evaluated in the alarm algorithms.
The CCF is calculated during a 36 hours period as follows:
During 13 minutes, all the momentary smoke obscuration values are saved and an average value is calculated. The CCF will be changed directly if the average value is lower than the actual CCF, else no change.
This is valid for 18 hours. Then the CCF will be changed also if the average value is higher than the actual CCF. (It will normally be higher because of contamination.)
After another 18 hours the CCF will be changed if the average value is lower or higher than the actual CCF and it will be saved in the detector's non-volatile memory.
A new 18 + 18 = 36 hours period starts with an average value calculation every 13th minute.

4.5.1. SERVICE SIGNAL

A service signal will be activated when the detectors CCF value is 2%/m and the detector has to be replaced.

4.6. SELF DIAGNOSIS OF INTERNAL DEVICES

The detectors perform an internal check of some vital functions and components (for example the IR-LED). A separate fault message will be shown in the CIE.

4.7. TEST MODE

For information about how to set the detector in test mode, see Planning Instructions or Operating Instructions.
When the detector is set in test mode, smoke will activate the fire alarm without heat. This allows the detector to be tested without using heat.
It is possible to use test aerosol equipment for testing. For example “SOLO” or “Testifire”.

5. FUNCTION

5.1. LIFETIME LIMIT SERVICE SIGNAL

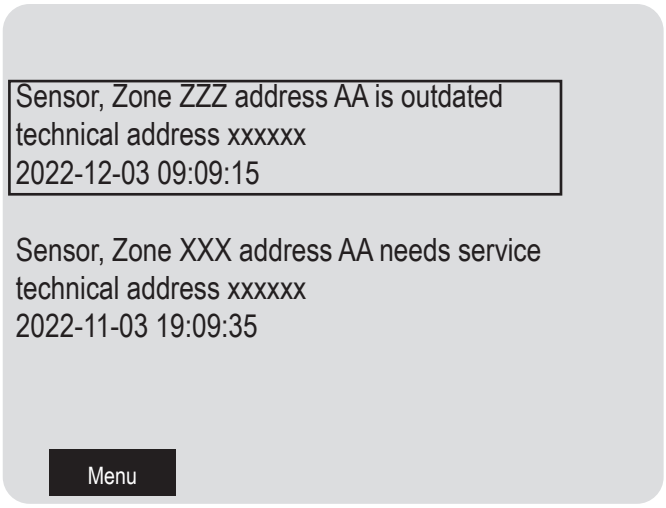
In some countries it is necessary to change the smoke detectors after a certain number of years.

The control unit will set the install date for the detector automatically when it detects a new detector.
The new detector 4400I keeps track of its install date to support this function. Therefore, a service signal is given for a 4400I detector older than the following number of years:

- Spanish convention: 10 years
- Belgian convention: 6 years
- German convention: 8 years
- Other conventions: 25 years

When the service signal is activated, there will be a list of sensors with a descriptive message found in:

- EBL512 G3; go to Sensors activating service signal menu H4/U5
- EBLOne; go to Service signal menu > >
- EBL128; go to Sensors activating service signal menu H4/U4



The message "…is outdated" is indicating an old detector.
The message "…needs service" is indicating a contaminated detector.

So there are different messages depending on if the detector is too old or is dirty.
If a detector fulfills both types of service signals, "dirty" has priority.

The install date can be read in menu 'Sensor values' and in EBLWin and EBLWeb.

- In EBL512 G3; go to Sensor values menu H4/U4
- In EBLOne; go to Sensor values menu > >
- In EBL128; go to Sensors values menu H4/U3

If the detector is programmed as 'Only heat detector' there should be no service signal.

6. SET THE COM LOOP ADDRESS

6.1. AUTO ADDRESSING

The 4400I multi detector supports automatic addressing via EBLWin.
For more information, see Planning instructions for the system, version 2.4.x or later.

6.2. MANUAL ADDRESSING

If auto addressing is not used, there is a possibility to manually set the address.
Each COM loop unit has to have a unique COM loop address (001-253). The address is set with the Address Setting Tool (4414E and 4414), or use the auto addressing function.

If the address setting tool is used, the COM loop address and mode settings have to be done before the unit is connected to the COM loop.

7. SET THE MODE

Since the 4400I multi detector is not backwards compatible with older detector types, only **Advanced mode** is supported.

If the control and indicating equipment is configured using 4400I as heat detector the normal mode algorithms will be used. These algorithms are calculated in the CIE. and not in the detector.
For more information, see Planning instructions for the system, version 2.4.x or later.

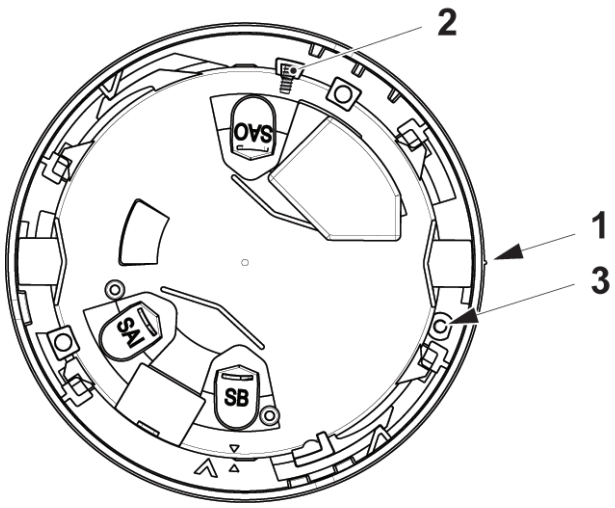
7.1. COMPATIBILITY TABLE

	Advanced mode	NORMAL mode	2330 mode	2312 mode
EBL512 G3	V ≥ 2.4	Not used	Not used	Not used
EBLOne	V ≥ 3.3	Not used	Not used	Not used
EBL128	Not used	Not used	Not used	Not used

8. MOUNTING

The detector is plugged in an analog base 4412F or sounder base 4479.
The 4400I multi detector will not fit in bases 3312, 3312F, 3312FL, or sounder base 3379.

Place the detector in the base with the detector's "Mark" in the same position as the "Mark" on the base and turn the detector clock-wise.



1. Mark
2. Position of locking screw (if used)
3. Locking screw hole (prepared for drilling through detector body)

8.1. LOCKING SCREW

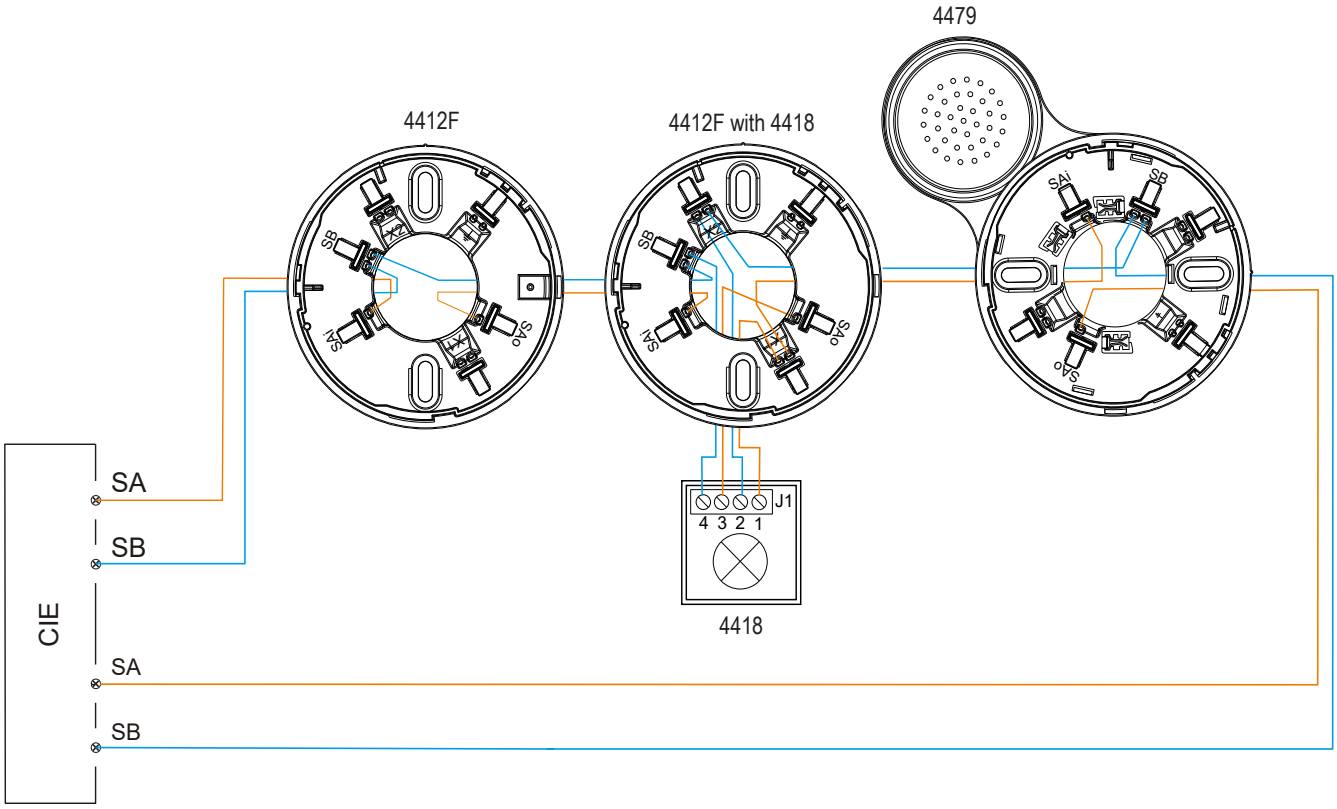
The detector is prepared for mechanical locking with analog base 4412F.
Attach a hexagon socket screw (1.5 mm Hex key to be used). The locking screw hole (2.5-2.7 mm) has to be drilled.

The hexagon socket screw is not supplied. It must be ordered separately.

9. INSTALLATION AND WIRING

The detector is plugged in an analog base 4412F sounder base 4479. The COM Loop is connected to the base.

Screen wire termination is not provided.



	4412F	4479
Wire size (Min)	Ø 0.6 mm (0.3 mm²)	Ø 0.6 mm (0.3 mm²)
Wire size (Max)	Ø 1.2 mm (1.13 mm²)	Ø 1.385 mm (1.50 mm²)

10. TECHNICAL DATA

All current consumptions are valid by nominal voltage and by 25 °C.

Voltage: Allowed Normal		 12 – 30V DC 24V DC
Current: Quiescent Active (incl. internal LED)		 0.3 mA (+0.025 if green polling LED is used) 1.3 mA
External LED		No
Address range		001-253
Address setting		Auto addressing / With address setting tool
Short circuit isolator		Built-in
Internal battery		No
Material		Polycarbonate Alloy
Ambient temperature: Operating Storage		 -10 to +50 °C -20 to +70 °C
Ambient humidity		Maximum 96 % RH (Non condensing)
Ingress protection rating		IP41
Size: Ø x H		 102 x 41 mm
Weight		76 g
Available Colour	4400I 4400I-B	White (10Y9/0.5, Munsell colour code) Matte Black (N1.5 Munsell colour code)

11. APPROVALS

Applicable directive/ Approval	Applicable standards	Notified body
CPR	EN54-5 EN54-7 EN54-17 EN54-29	VdS No. 0786-CPR-21553
VdS	EN54-5 EN54-7 EN54-17 EN54-29 VdS2344 VdS2543	VdS No. G217086
EMC	EN61000-6-3 (Emission) EN50130-4 (Immunity)	Self declaration VdS
RoHS	EN IEC 63000	Self declaration

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Panasonic Fire & Security Europe AB
Jungmansgatan 12
SE-211 11 Malmö
Sweden
Tel: +46 (0)40 697 70 00